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Resources needed for peforming Shor's algorithm with Ising Anyons MARA BARABAN, Yale University, STEVEN SIMON, Oxford University, NICK BONESTEEL, Florida State University — While Ising anyons, the presumed quasiparticles of the $\nu = 5/2$ fractional quantum Hall state, do obey non-Abelian statistics, their braid group is not sufficiently rich to support universal quantum computation (UQC). Recently, Bravyi [1] proposed a method for combining topological and non-topological operations that exploits the topological protection of the Ising anyons to allow for UQC even with very low accuracy non-topological operations. Starting from Bravyi's proposal, we calculate the resources required to perform Shor's algorithm. We find that when parallelization is included, the required number of qubits grows as the number of gates ($\sim N^3$, where N is the length of the number to be factored using Shor's algorithm) and that the total time required is nearly independent of N. Numerical work has further allowed us to determine how far apart the anyons must be in a realistic sample in order to perform topological operations. We thus estimate how large a coherent sample would be required for Ising anyons to successfully execute modular exponentiation. We compare our results to the requirements for performing Shor's algorithm via fully topological quantum computation with Fibonacci anyons, the presumed quasiparticle excitation of the $\nu = 12/5$ fractional quantum Hall state. [1] S. Bravyi, Phys. Rev. A **73**, 042313 (2006)

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